

BACKGROUND OF THE INVENTION

This invention relates to a recording medium cartridge of the type which includes a memory for storing information concerning signals recorded on the recording medium, and more particularly is related to a manner of storing information in the memory of such a recording medium cartridge so as to promote higher efficiency in the management and retrieval of the information stored in the memory and of the signals recorded on the recording medium.

In a known type of recording medium cartridge, such as a magnetic tape cassette, information concerning the magnetic tape, such as the thickness, the type, the length, the grade, etc., of the magnetic tape, can be determined on the basis of a plurality of detection holes (hereinafter referred to as "recognition holes") that are provided at a corner of the rear face of the cassette.

However, as the size of cartridges has been reduced, it has become increasingly difficult both to provide locations for the recognition holes and to provide a desired amount of information using the number of recognition holes which are available.

Moreover, in order to determine what materials are recorded on the magnetic tape, it is necessary to advance or rewind the magnetic tape to reach the position on the tape at

1 which the material of interest is recorded. This often requires  
2 a significant period of time.

3 To overcome these problems, it has been proposed to  
4 include in a recording medium cartridge a memory, separate from  
5 the magnetic tape, for storing information with respect to the  
6 cartridge and the materials recorded on the tape. Such a  
7 recording medium cartridge is disclosed, for example, in U.S.  
8 Patent Nos. 4,338,644 and 4,383,285.

9 With a recording medium cartridge of the type just  
10 described, having a memory for storing information concerning the  
11 materials recorded on the recording medium, it is important that  
12 the information stored in the memory accurately reflect the  
13 materials recorded on the recording medium and also that the  
14 information stored in the memory be managed efficiently.  
15 However, the prior art fails to disclose any system for managing  
16 the information stored in the memory.

17 OBJECTS AND SUMMARY OF THE INVENTION

18 Accordingly, it is an object of the present invention  
19 to provide a method of storing information in the memory of a  
20 recording medium cartridge using a predetermined technique which  
21 facilitates efficient management of the materials recorded on the  
22 recording medium.

23 Another object is to divide the program materials  
24 recorded on the recording medium into a number of separate groups  
25 corresponding to different categories of programs and to organize

1 the groups in the form of a hierarchic or tree structure to  
2 facilitate management of the program materials.

3 A further object of the invention is to provide a  
4 recording medium cartridge having a memory for storing  
5 information concerning programs recorded on the recording medium,  
6 with the information being stored so as to divide the programs  
7 into groups for facilitating classification of the programs and  
8 searching for, and reference to, the recorded programs.

9 In accordance with an aspect of the present invention,  
10 a method of storing information representative of signals  
11 recorded on a recording medium accommodated within a recording  
12 medium cartridge includes the steps of providing a memory device  
13 as part of the recording medium cartridge and storing the  
14 information in the form of a tree structure that includes at  
15 least a plurality of directory entries each having associated  
16 therewith a plurality of data items. Each of the data items  
17 represents a respective portion of the signals recorded on the  
18 recording medium, and contains data indicative of a starting  
19 position and a ending position on the recording medium of the  
20 respective portion of the signals.

21 According to another aspect of the invention, at least  
22 some of the data items are formed of at least one data packet and  
23 each data packet has a fixed length and a predetermined format  
24 and includes a level code indicative of a level of the tree

1 structure, the data packet being assigned to that level of the  
2 tree structure.

3 According to a further aspect of the present invention,  
4 there is provided a method of retrieving information  
5 representative of signals recorded on a recording medium  
6 accommodated within a recording medium cartridge, with the  
7 information having been stored in the form of a tree structure in  
8 a memory device provided as part of the recording medium  
9 cartridge and the method including the steps of loading the  
10 recording medium cartridge in a recording and reproducing  
11 apparatus that is operatively connected to a display device, and  
12 displaying at least some of the information on the display  
13 device. According to further aspects of the invention the  
14 signals recorded on the recording medium include video signals,  
15 the display device is a video monitor or a television receiver,  
16 the information stored in the memory device includes image data  
17 representative of respective portions of the video signals and  
18 the displaying step includes displaying a plurality of images  
19 simultaneously in split-screen form, with each of the displayed  
20 images representing a respective portion of the video signals  
21 recorded on the recording medium.

22 According to yet another aspect of the invention, there  
23 is provided a recording medium cartridge which includes a  
24 housing, a recording medium accommodated within the housing, a  
25 memory device carried by the housing, and terminals associated

1 with at least one outer surface of the housing for providing  
2 electrical connections between the memory device and a  
3 reproducing apparatus with which the cartridge is to be used.  
4 The memory device has stored therein data signals representative  
5 of program information recorded on the recording medium. The  
6 data signals are stored in the form of a tree structure including  
7 at least a plurality of directory entries each having associated  
8 therewith a plurality of data items. Each of the data items  
9 represents a respective portion of the program information, and  
10 contains data indicative of a starting position and an ending  
11 position on the recording medium of the respective portion of the  
12 program information.

13 The information storage and retrieval methods and the  
14 recording medium cartridge as just described permit efficient  
15 management of the stored information relating to the recorded  
16 program materials and provide for rapid and convenient access to  
17 the recorded program materials.

18 The above, and other objects, features and advantages  
19 of the present invention will be apparent from the following  
20 detailed description thereof which is to be read in connection  
21 with the accompanying drawings.

#### 22 BRIEF DESCRIPTION OF THE DRAWINGS

23 Figs. 1(a) and 1(b) diagrammatically illustrate a basic  
24 data item used in forming a data structure according to the  
25 present invention;

1           Fig. 2 schematically illustrates a portion of a signal  
2   that is recorded on magnetic tape and which corresponds to one of  
3   the data items of Figs. 1(a) or 1(b);

4           Fig. 3 diagrammatically illustrates an extended data  
5   item in which additional information has been added to the basic  
6   data item of Figs. 1(a) or 1(b);

7           Fig. 4 diagrammatically illustrates another extended  
8   data item with further information added to the data item of Fig.  
9   3;

10           Fig. 5 diagrammatically illustrates still another  
11   extended data item formed by adding image data to a basic data  
12   item;

13           Fig. 6 diagrammatically illustrates a tree structure  
14   formed using basic data items;

15           Fig. 7 schematically illustrates signals recorded on a  
16   magnetic tape and corresponding to the tree structure of Fig. 6;

17           Fig. 8 schematically illustrates tree structure levels  
18   characteristic of pre-recorded tapes and user tapes;

19           Fig. 9 diagrammatically illustrates a complete tree  
20   structure formed using basic data items;

21           Fig. 10 diagrammatically illustrates a sequence of  
22   memory locations in which are stored data items corresponding to  
23   the tree structure of Fig. 9;

24           Fig. 11 diagrammatically illustrates another tree  
25   structure formed using basic data items;

1           Fig. 12 diagrammatically illustrates a tree structure  
2    which includes a directory entry corresponding to a highlight  
3    scene;

4           Fig. 13 diagrammatically illustrates a tree structure  
5    including a directory entry which corresponds to a custom file;

6           Fig. 14 diagrammatically illustrates a hierarchic data  
7    structure corresponding to a blank cartridge;

8           Fig. 15 is a flow chart which illustrates a procedure  
9    for managing information with respect to either a blank or a  
10   recorded cartridge;

11           Fig. 16 diagrammatically illustrates in the form of a  
12   tree structure automatic creation of directory entries during  
13   signal recording operations in accordance with the present  
14   invention;

15           Fig. 17 diagrammatically illustrates creation of a new  
16   directory entry within the tree structure shown in Fig. 16;

17           Fig. 18 diagrammatically illustrates application of a  
18   title to the new directory entry of Fig. 17;

19           Fig. 19 diagrammatically illustrates association of  
20   program segments with the new directory entry of Figs. 17 and 18;

21           Fig. 20 diagrammatically illustrates addition of a new  
22   data item to the tree structure of Fig. 19 upon commencement of a  
23   signal recording operation;

1           Fig. 21 diagrammatically illustrates modification of  
2 the tree structure of Fig. 20 by the addition of another  
3 directory entry with program segments associated therewith;

4           Fig. 22 diagrammatically illustrates modification of  
5 the tree structure of Fig. 21 by applying a title to a previously  
6 untitled directory entry;

7           Fig. 23 diagrammatically illustrates a tree structure  
8 for information stored with respect to program materials on a  
9 pre-recorded tape;

10          Fig. 24 schematically illustrates recorded signal  
11 portions selected to form a digest of a program on a pre-recorded  
12 tape;

13          Fig. 25 diagrammatically illustrates a tree structure  
14 which includes a directory entry corresponding to the digest  
15 illustrated in Fig. 24;

16          Fig. 26 is a table which illustrates the format of a  
17 data packet used for storing information in the memory of a  
18 recording medium cartridge in accordance with the present  
19 invention;

20          Fig. 27 is a table which shows codes to be used in the  
21 data packet of Fig. 26 for identifying a level to which the data  
22 packet is assigned in a tree structure;

23          Fig. 28 is a perspective view of a recording medium  
24 cartridge provided with a memory device in accordance with the  
25 present invention;



Fig. 29 is a cross-sectional view of a portion of the recording medium cartridge of Fig. 28;

Fig. 30 is a semi-schematic perspective view of a printed wiring board embodying the memory device incorporated in the recording medium cartridge of Fig. 28;

Fig. 31 is a simplified block diagram illustrating a system in which the recording medium cartridge of Fig. 28 may be used;

Fig. 32 is a flow chart of a procedure for entering data items in a recording medium cartridge memory in accordance with the present invention;

Fig. 33 illustrates a screen display viewed by the user during entry of text information into the recording medium cartridge memory;

Fig. 34 illustrates a screen display of information stored in the recording medium cartridge memory; and

Fig. 35 shows a split-screen display containing multiple images reproduced from image data stored in the recording medium cartridge memory and representing respective recorded program segments.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring initially to Fig. 28, a recording medium cartridge 31, in accordance with an embodiment of the invention, includes a case 32 that is formed in the shape of a flat, rectangular box by joining together a top half case 36 and a

1 bottom half case 37. The recording medium cartridge 31 also  
2 includes a pair of tape reels 33 disposed within the case 32, and  
3 an IC plate 34 carried within the case 32 and provided with  
4 terminals 35 accessible from outside of the case 32.

5 The case 32 includes a bottom wall 38 having formed  
6 therein holes 39 for providing access to the tape reels 33 and  
7 terminal slots 40 for providing access to the terminals 35 of the  
8 IC plate 34. The bottom wall 38 also includes a recess 41 across  
9 which a magnetic tape (not shown) is extended. It will be  
10 understood that the magnetic tape, which is not shown, is wound  
11 in a conventional manner on the tape reels 33. The cartridge 31  
12 also includes a lid 42 which is displaceable in a conventional  
13 manner between a closed position which protects the tape and  
14 covers a front opening of the case 32 and an open position which  
15 exposes the magnetic tape.

16 Referring now to Figs. 29 and 30, the IC plate 34  
17 includes a printed wiring board 44 having terminals 35 formed  
18 thereon. An IC chip 45, i.e., a semiconductor memory device, is  
19 mounted on the printed wiring board 44. The IC plate 34 is  
20 retained in a shallow, substantially rectangular recess 43 that  
21 is formed in the inner surface of the bottom wall 38 of the case  
22 32 at the middle of a rear portion of the bottom wall 38. The  
23 four terminal slots 40 are arranged laterally in the recess 43.  
24 The IC plate 34 and recess 43 are dimensioned so that the IC  
25 plate 34 fits snugly in the recess 43.

1           The terminals 35 are rectangular and are elongated in  
2     the widthwise direction of the case 32. The terminals 35 extend  
3     in parallel and are arranged in a sequence in the lengthwise  
4     direction of the case 32 in positions corresponding to respective  
5     terminal slots 40. The terminals 35 are preferably gold-plated  
6     to provide lasting and reliable electrical contacts.

7           A circuit pattern formed on the printed wiring board 44  
8     connects the terminals 35 with the IC chip 45. The terminals 35  
9     include, for example, a power supply terminal 35a, a data  
10    input/output terminal 35b, a clock terminal 35c, and a ground  
11    terminal 35d. The IC plate 34 is secured within the recess 43 of  
12    the bottom wall 38 by welding, an adhesive or the like, and is  
13    positioned with the IC chip 45 facing downwardly with respect to  
14    the case 32 and the terminals 35 presented for access via  
15    respective terminal slots 40.

16           Fig. 31 schematically illustrates a video system 50 in  
17    which the recording medium cartridge 31 (in this case a video  
18    tape cassette) may be used. The video system 50 includes a video  
19    tape recorder (VTR) 51 in which the tape cassette 31 is inserted  
20    and which is connected to a television receiver 52 for display of  
21    video signals reproduced from the cassette 31. A remote control  
22    unit 54 is provided for a user to enter control commands for the  
23    VTR 51, and an antenna 56 is provided as a signal source for the  
24    VTR 51.

1           Video signals received via antenna 56 are supplied to a  
2   tuner 58 and a tuned signal output from the tuner 58 is processed  
3   by a video signal processor 60 for recording on a magnetic tape 6  
4   accommodated within tape cassette 31.

5           The VTR 51 also includes an output processor 62 which  
6   processes video signals reproduced from the tape 6 of tape  
7   cassette 31 and outputs the processed signals for display by the  
8   TV receiver 52. Although not explicitly shown in the simplified  
9   block diagram of Fig. 31, it should be understood that the VTR 51  
10   includes a rotary magnetic recording head and associated  
11   circuitry for recording on the magnetic tape 6 the signal  
12   provided by video signal processor 60 and for reproducing from  
13   the magnetic tape 6 a signal to be processed by output processor  
14   62.

15           The IC memory chip 45 carried in tape cassette 31 is  
16   connected for data communication, via at least one of the  
17   terminals 35 (Figs. 28-30), with a microprocessor 64 provided  
18   within VTR 51 (Fig. 31). The microprocessor 64 may, for example,  
19   be the primary control circuit for controlling all the operations  
20   of VTR 51. Accordingly, microprocessor 64 is connected for  
21   receiving command signals from the remote control unit 54 by way  
22   of remote receiving circuitry 66 which is in communication with  
23   the remote control unit 54 via a wireless signal path 68. It  
24   will be understood that the microprocessor 64 has associated

1 therewith conventional circuits such as program memory and  
2 working memory, which are not separately shown.

3           The VTR 51 also includes a VBI decoder 70 which  
4 separates vertical blanking interval code signals from the tuned  
5 video signal provided by tuner 58 and provides decoded signals to  
6 the microprocessor 64. VTR 51 also includes a frame memory 72  
7 which stores one or more frames of reproduced video signals  
8 output from output processor 62 and provides the signals, in the  
9 form of digital data, to the microprocessor 64.

10           The microprocessor 64 is also preferably employed for  
11 controlling advancing or rewinding of the magnetic tape 6 by  
12 means of a tape transport mechanism that is not shown in Fig. 31.  
13 The microprocessor 64 accordingly has access to data indicative  
14 of the position of tape 6 relative to the winding or unwinding  
15 thereof within cassette 31.

16           The manner of storing data in the memory 45 of the  
17 video tape cassette 31 will now be described. Referring  
18 initially to Figs. 1(a) and 1(b), a basic data item 1 represents  
19 a minimum unit of data stored in the memory 45 for the purpose of  
20 keeping track of video signals recorded on the tape 6 of tape  
21 cassette 31. As shown in Fig. 1(a), the data item 1 includes a  
22 time code 2 which represents a starting point of a recorded video  
23 signal portion and a time code 3 which represents the end point  
24 of the video signal portion. Alternatively, the basic data item  
25 may take the form of the data item 1' (Fig. 1(b)), in which the

1 starting point of the signal portion is represented by a track  
2 number 2' and the ending point is represented by a track number  
3 3'. In the following description, it will be assumed that the  
4 data item 1, including time codes, is used, rather than the data  
5 item 1', which includes track numbers.

6 The data item 1 corresponds, as shown in Fig. 2, to a  
7 video signal that is recorded at a particular section 7 of a  
8 magnetic tape 6 wound around reels 33 of the video tape cassette  
9 31. The recorded area 7 is defined by a starting point 8 which  
10 corresponds to the time code 2 of the data item 1 and by an  
11 ending point 9 which corresponds to the time code 3 of the data  
12 item 1. The length of the recorded area 7 is arbitrary, and may  
13 be fixed as the area corresponding to one frame or may be of  
14 variable length corresponding, for example, to a recorded  
15 program.

16 The basic data item 1 can be extended by addition of  
17 data of various types. For example, and as shown in Fig. 3, text  
18 data representing a program name 10 can be added to the data item  
19 so that the data item includes the program name data 10 in  
20 addition to the starting time code 2 and the ending time code 3.  
21 It will be appreciated that the program name 10 may be, for  
22 example, the title of a movie recorded in the tape area defined  
23 by the starting and ending time codes.

24 Further, as shown in Fig. 4, the data added to the data  
25 item 1 may include, in addition to the program name 10, a program

1 number 11 and a date of recording 12. For example, the program  
2 number 11 may be "program 1", the program name 10 may be  
3 "overseas tour" and the date may be "May 5, 1992".

4 In each of the examples described with respect to Figs.  
5 3 and 4, the additional information has been in the form of text  
6 information. Alternatively, however, the additional information  
7 may take the form of image data 13 (as shown in Fig. 5) which  
8 represents an image indicative of the contents of the video  
9 signal recorded in the tape area defined by the time codes 2 and  
10 3. In the particular example shown in Fig. 5, it will be noted  
11 that the additional information includes both image data 13 and a  
12 program name 10. Thus, it will be seen that mixed types of data  
13 may be included in the additional information added to the basic  
14 data item 1. The types of data may include text data, image  
15 data, audio data, executable software files, codes indicative of  
16 copyright protection, and so forth.

17 There will now be described a data structure based upon  
18 the fundamental data items as shown in Fig. 1 and used for  
19 storing the data in the memory 45 of tape cassette 31. It will  
20 be understood that if a number of recording operations are  
21 performed using the tape cassette 31 so that a number of video  
22 signal portions are formed in respective areas of tape 6, then a  
23 corresponding number of basic data items 1 will be accumulated in  
24 the memory 45.

1           For example, as shown in Fig. 6, if three programs have  
2   been recorded on the tape, there are three data items present in  
3   the memory 45, each corresponding to a respective one of the  
4   three programs. A first one of the three data items includes a  
5   time code TC1 representing a starting point, and a time code TC2  
6   representing an ending point, of the first program as well as a  
7   first program name corresponding to the first program. With  
8   respect to the second program, there is a second data item  
9   including a starting time code TC3, an ending time code TC4, a  
10   second program name and a recording date. Similarly, with  
11   respect to a third program, there is a third data item including  
12   a starting time code TC5, an ending time code TC6, and a third  
13   program name.

14           The corresponding tape areas having the respective  
15   programs recorded thereon are schematically shown in Fig. 7, with  
16   the area in which the first program is recorded being defined by  
17   time codes TC1 and TC2, the area in which the second program is  
18   recorded being defined by time codes TC3 and TC4 and the area in  
19   which the third program is recorded being defined by time codes  
20   TC5 and TC6.

21           It should be understood that each of these areas may  
22   represent either a recorded portion or a blank portion of the  
23   tape. Of course, when the respective area is blank, the  
24   corresponding data item includes only the starting and ending



1 time codes, and does not include additional information such as a  
2 program name or a recording date.

3 As illustrated in Figs. 6 and 7, the three programs may  
4 be formed into a group under a descriptive name such as "drama"  
5 which may be applied to the group. In particular, a hierarchic  
6 or tree data structure is formed in which the three data items  
7 corresponding to the three programs are associated with the group  
8 name "drama". The data entry including the group name is formed  
9 at a higher level of the tree structure than the level at which  
10 the three program data items are formed, all of the three program  
11 data items being at a common level. This structure may be  
12 implemented by creating a new folder in the memory 45 with the  
13 data items corresponding to the three programs being processed so  
14 as belong to the new folder.

15 There will now be discussed, with reference to Fig. 8,  
16 the types of data structure levels to be used in a tree or  
17 hierarchy for either the pre-recorded tape (such as a movie or a  
18 music recording), or for a user tape (that is, a tape on which a  
19 purchaser of the tape has performed the recording).

20 Turning, then, to Fig. 8, it will be noted that three  
21 types of levels are included in the tree structure for a pre-  
22 recorded tape, namely a title level, a chapter level, and a part  
23 level. The chapter level is for gathering a plurality of parts  
24 into a group under one of the chapters and the title level is for

1 gathering a plurality of chapters together as a group in  
2 association with the title.

3 On the other hand, for a user tape two levels are  
4 provided, a title level and a program level. The title level is  
5 for gathering together in a group a plurality of programs to be  
6 associated with the title. The numbers of levels shown in Fig. 8  
7 are by way of example only, and the number of levels can be  
8 increased if necessary.

9 Fig. 9 shows an example of a tree structure for data  
10 corresponding to video signals recorded by a user on the tape  
11 cassette 31. As seen in Fig. 9, the data stored in the memory 45  
12 proceeds from a root 14 into two divisions or branches, which are  
13 a recording medium information branch 15 and a recorded content  
14 information branch 16, the latter representing information  
15 concerning the signals that have been recorded on the tape.

16 The recording medium information branch 15 includes  
17 identification information 17 with respect to the recording  
18 medium cartridge itself as well as miscellaneous additional data  
19 18. The identification information 17 may include, for example,  
20 tape thickness information 17a, tape type information 17b, tape  
21 length information 17c, tape grade information 17d and a code 17e  
22 for identifying the manufacturer. The miscellaneous additional  
23 data 18 may include such information as date of manufacture, lot  
24 number, etc.

1           The recording content information is stored in the form  
2 of a tree structure, of which the highest level 19 includes  
3 cartridge title information 19a and cartridge number information  
4 19b. The data items for implementing the highest level 19 of the  
5 branch 16 are, like the branch 15, present in the memory 45 of  
6 each cartridge. It will be understood that information which  
7 relates to the entire recording medium cartridge is stored in the  
8 recording medium information branch 15 and in the highest level  
9 19 of the recorded content information branch 16. Moreover, the  
10 information stored in the recording medium information branch 15  
11 is fixed, whereas the information stored in the highest level 19  
12 of the other branch 16 is variable information and can be changed  
13 by a user.

14           Beneath the highest level 19 of the branch 16 there is  
15 provided a hierarchic structure for the rest of the branch 16,  
16 including title and program information. In particular, title  
17 level entries corresponding to a "MOVIE 1" and a "MOVIE 2" are  
18 present. Program level entries for programs 1-3 are associated  
19 with the entry for "MOVIE 1" at a program level that is below the  
20 title level, and program level entries for programs 1 through 4  
21 are associated with the title level entry for "MOVIE 2".

22           Fig. 10 indicates the sequence in which the information  
23 illustrated in Fig. 9 is stored in the memory of the recording  
24 medium cartridge. The sequence shown in Fig. 10 starts from the  
25 lowest-numbered address location and proceeds to higher-numbered

1 addresses. The recording medium information is stored at the  
2 beginning of the sequence, followed by the information relating  
3 to the signals recorded on the tape.

4 More specifically, the common identification  
5 information (corresponding to branch 15 of Fig. 9), including  
6 data relating to the recording medium and data identifying the  
7 manufacturer, etc., is stored first, followed by other  
8 miscellaneous information. Next is the cassette identifying  
9 information, such as number and title, and after that the  
10 hierarchically arranged data is stored, with each item of title  
11 level information being followed with the lower level (program  
12 level) entries associated with the title level entry. That is,  
13 the title level entry for "MOVIE 1" is followed by the three  
14 program entries associated with "MOVIE 1". Then the title level  
15 entry for "MOVIE 2" is stored, followed by the four program level  
16 entries associated with "MOVIE 2".

17 Although Fig. 10 illustrates the data arrangement  
18 corresponding to a user tape directory as shown in Fig. 9, it  
19 will be understood that a similar hierarchic data arrangement is  
20 used in storing directory data for a pre-recorded tape.

21 Fig. 11 shows another hierarchic directory data  
22 structure for a user tape. The structure shown in Fig. 11  
23 differs from that of Fig. 9 in that it has, as part of the title  
24 level entry, a starting point time code and an ending point time  
25 code for all of the program materials associated with the title

1 level entry. In other words, the title level entry for "MOVIE 1"  
2 includes the starting point time code TC1 representing the  
3 starting point on the tape of the first program associated with  
4 "MOVIE 1" and also the time code TC6 representing the ending  
5 point of the third and last program associated with "MOVIE 1".  
6 Similarly, the title level entry for "MOVIE 2" includes a  
7 starting point time code TC7 and an ending point time code TC14,  
8 which respectively represent the starting point of the first  
9 program, and the ending point of the fourth and last program,  
10 associated with the title level entry "MOVIE 2".

11 In the directories illustrated by Figs. 9-11, the data  
12 simply corresponds to the recorded materials and their respective  
13 recording locations on the recording medium. However, the  
14 directory structure also permits the user to create additional  
15 directory entries to provide special indexing or other functions.  
16 For example, the user may provide a "HIGHLIGHT SCENE" entry  
17 corresponding to a particular portion of the recorded materials  
18 which are of special interest to the user or which are desired to  
19 be readily available for reproduction. Specifically, as shown  
20 in Fig. 12, a title level entry 20 has been given the name  
21 "HIGHLIGHT SCENE" and has associated therewith a starting point  
22 20a and an ending point 20b which define the starting and ending  
23 points of the scene which is of special interest to the user.  
24 Also associated with the "HIGHLIGHT SCENE" entry is additional  
25 information designated by reference numeral 21 and which is image

1 data representing a frame out of the recorded material in the  
2 area defined by the starting point 20a and ending point 20b.  
3 This frame may be displayed as an index or title picture to  
4 identify the directory entry 20. Alternatively, or in addition  
5 to the title picture data, other information, such as a scene  
6 number of the like, can be included in the program level entry  
7 associated with the title level entry "HIGHLIGHT SCENE".

8 In selecting and carrying out a procedure in which a  
9 "highlight scene" directory entry is created, the user may be  
10 guided, for example, by a series of menus and submenus displayed  
11 on the screen of TV receiver 52 (Fig. 31). The character  
12 information for the menus and submenus may be generated by the  
13 microprocessor 64 and output via output processor 62. The menu  
14 may include an item such as "CREATE HIGHLIGHT SCENE FILE". When  
15 this item is selected by, for example, suitable operation of  
16 remote control unit 54, submenu items and/or prompt messages such  
17 as "SELECT STARTING POINT OF HIGHLIGHT SCENE FILE", "SELECT  
18 ENDING POINT OF HIGHLIGHT SCENE FILE", "ENTER NAME OF HIGHLIGHT  
19 SCENE FILE", "CANCEL HIGHLIGHT SCENE FILE", may be displayed by  
20 the TV receiver 52 from character information generated by the  
21 microprocessor 64. It will be appreciated that the menu  
22 items/prompts may appear superimposed over images reproduced from  
23 the recording medium. Again, selection of menu items and  
24 indication of starting and ending points of the highlight scene

1 program segment may be indicated by operation of the remote  
2 control unit 54.

3 As another example, and as illustrated in Fig. 13, the  
4 user can create a "custom file" selected from previously recorded  
5 programs. In particular, for the purposes of the example shown  
6 in Fig. 13 it is assumed that ten programs have previously been  
7 recorded and that the user desires to have certain of these  
8 programs reproduced in an order different from the order in which  
9 the programs are recorded. The directory entry 22 can be created  
10 for the purpose of selecting the programs and the order of  
11 reproduction. For example, the directory entry 22 can include  
12 data which will cause program number 2 to be reproduced first,  
13 followed by program number 10 and then program number 4. After  
14 creating this custom file 22, if the user then selects the custom  
15 file to control reproduction, then the reproduction of program  
16 materials will occur with program 2 reproduced first, then  
17 program 10, then program 4.

18 As was the case in creation of the highlight scene  
19 file, creation of the custom file may be guided by menus and/or  
20 prompts and carried out in response to command signals generated  
21 using the remote control unit 54. It will be understood that a  
22 graphical user interface may also be employed, in which the tree  
23 structure of Fig. 13 is displayed by TV receiver 52, together  
24 with pull-down menus or the like. In this case, the remote  
25 control unit 54 may include a track ball or the like, instead of

1 or in addition to arrow keys, for the purpose of positioning a  
2 cursor for selecting menu items, or for selecting graphically  
3 represented files for manipulation.

4 There will now be described, with reference to Figs.  
5 14-22, a sequence of operations in which materials are recorded  
6 on a blank recording medium cartridge while corresponding  
7 directory information is stored in the memory carried in the  
8 recording medium cartridge.

9 First, referring to Fig. 14, there is shown a  
10 diagrammatic representation of the directory for a blank  
11 cartridge. As before, a recording medium information branch 15  
12 and a recorded content information branch 16 appear under a root  
13 item 14. (Although root item 14 is shown for conceptual purposes  
14 in Fig. 14, it should be understood that in terms of the actual  
15 information stored in the recording medium cartridge memory, the  
16 root item 14 may be a "phantom" or nonexistent item.)

17 All of the data making up the recording medium  
18 information branch 15 is present in the recording medium  
19 cartridge memory, including the common identification information  
20 17 and the miscellaneous additional data 18, as previously  
21 described, for example, with respect to Fig. 9. However, at this  
22 point, since the cartridge is blank, the recorded content  
23 information branch 16 consists only of a dummy title level entry  
24 in which no identifying information has been recorded.



Fig. 15 illustrates in the form of a flow chart a procedure in which program information is recorded on, and reproduced from, the recording medium of the cartridge, with corresponding storage of information in the memory and reference to previously stored information.

The procedure illustrated in Fig. 15 starts with step S1 in which the cartridge is inserted into a recording and reproducing apparatus (such as the video tape recorder 51 of Fig. 31). Then at step S2, it is determined whether the cartridge is a blank cartridge or whether materials have previously been recorded in the cartridge.

If the cartridge is not blank, then step S3 follows at which information relating to the recorded contents is displayed (for example, on TV receiver 52 of Fig. 31). The procedure then continues by awaiting a command (step S4), which is followed, in a typical case, with the selection of a directory entry (step S5) by means of remote control unit 54 (Fig. 31) or the like.

After a directory entry is selected at step S5, step S6 follows, at which the apparatus advances or rewinds the tape in order to locate the starting point of the program segment associated with the directory entry.

The following step is step S7, at which it is determined whether or not to proceed with a recording operation. If not, step S10 may follow, with actuation of a reproduction button, followed by reproduction (step S11) of the program

1 materials corresponding to the directory entry selected at step  
2 S6.

3           Returning to step S2, if it is determined that the tape  
4 is blank, the routine again awaits entry of a command (step S8).  
5 Actuation of a recording button may follow (step S9), which is  
6 also the step which may follow step S7 if it was determined at  
7 step S7 to proceed with a recording operation. In either case,  
8 upon the commencement of recording in response to step S9, a new  
9 directory entry is created (step S12) and the time code  
10 representing the point on the tape at which recording has begun  
11 is included in the entry (step S13). Recording then continues  
12 until a stop or pause is directed by the user (step S14) and at  
13 that point a time code representative of the stopping point on  
14 the tape is added to the new directory entry (step S15). The  
15 routine then ends (step S16).

16           Fig. 16 illustrates the data structure which exists  
17 after three program segments, respectively represented by TC1-  
18 TC2, TC3-TC4 and TC5-TC6, have been recorded by three iterations  
19 of the steps S9-S15. Gathering of these three program segments  
20 together into a group will now be described with reference to  
21 Figs. 17-19. First, as shown in Fig. 17, a new directory entry  
22 is created without any identifying information having been  
23 applied thereto. Next, a name such as "DRAMA 1" is applied to  
24 the newly created directory entry, as shown in Fig. 18. Then, by  
25 entry of suitable commands, the three program segments TC1-TC2,

1 TC3-TC4 and TC5-TC6 are subsumed under the directory item "DRAMA  
2 1", now indicated by reference numeral 24 in Fig. 19. In other  
3 words, the three program segments are associated with the  
4 directory entry "DRAMA 1" and are placed at a level below the  
5 level of the directory entry "DRAMA 1".

6 At this point, if the user selects the "DRAMA 1" entry  
7 and then proceeds to record material, a new directory entry  
8 including the recording start point time code TC7 is formed at a  
9 level below, and associated with, the "DRAMA 1" entry, as shown  
10 in Fig. 20. Several new directory entries produced in this  
11 manner may subsequently be gathered together under a new  
12 directory entry such as "DRAMA 2", as shown in Fig. 21, in a  
13 manner similar to that shown with respect to Figs. 17-19. In the  
14 particular example shown in Fig. 21, it will be understood that  
15 three program segments are associated with the higher level  
16 directory entry "DRAMA 1" (reference numeral 24) while two  
17 program segments (TC7-TC8 and TC9-TC10) are associated with the  
18 directory entry "DRAMA 2" (reference numeral 26) which is at the  
19 same level as the directory entry "DRAMA 1".

20 To complete the directory structure, the heretofore  
21 untitled cartridge may be assigned a title such as "POPULAR  
22 DRAMA" as shown in Fig. 22.

23 As discussed previously in connection with Fig. 13, the  
24 user interface for carrying out the functions illustrated in  
25 Figs. 15-22 may include displaying on TV receiver 52 some or all

1 of the tree structures shown in Figs. 16-22, and operating a  
2 track ball, "select" key, etc. provided on remote control unit 54  
3 for selection of menu items and/or creation of new files or  
4 manipulation of existing files. The interface may resemble, for  
5 example, that of conventional "desktop" file management and/or  
6 drawing/flow-charting software packages. Alternatively, a  
7 largely menu-based interface may be provided. In the latter  
8 case, menu items such as "CREATE NEW DIRECTORY ENTRY", "APPLY  
9 NAME TO DIRECTORY ENTRY", "SELECT PROGRAM", "ASSOCIATE PROGRAM  
10 WITH DIRECTORY ENTRY", etc. may be used.

11 It has been noted that the directory structure  
12 described above with reference to Figs. 15-22 is for a user tape.  
13 The directory provided with a pre-recorded tape will be explained  
14 now with reference to Fig. 23. It will be understood that in a  
15 pre-recorded tape, normally the entire tape has material recorded  
16 continuously thereon from beginning to end. The directory  
17 structure for the tape, as shown in Fig. 23, like the user tape  
18 directory, includes a root item 14 (which may be phantom item), a  
19 cartridge information branch 15 containing information of the  
20 type previously described with reference to the corresponding  
21 branch in the user tape directory, and a recorded content branch  
22 16, which comes fully formed with appropriate directory entries  
23 as shown in Fig. 23. More particularly, a cartridge title,  
24 typically corresponding to the title of the program material  
25 (such as a "MOVIE") recorded therein is present in branch 16,

1 along with two title level directory entries, one of which  
2 indicates the body of the material (such as the movie itself) and  
3 the other of which indicates additional material such as a  
4 "trailer" or other advertising material. The "body" title level  
5 entry has associated therewith five chapter level entries each  
6 including chapter identifying data and corresponding starting and  
7 ending time codes. It will also be noted that associated with  
8 the chapter 1 entry are two part level entries, also with  
9 corresponding starting and ending time codes. The division of  
10 the recorded material into chapters and parts is flexible in the  
11 sense that the data stored in the memory can be rewritten so as  
12 to designate a different number of chapters and parts and/or  
13 different starting and ending points for the chapters and parts.

14 The user is also free to prepare a "digest" of the  
15 recorded materials. Referring to Figs. 24 and 25, a directory  
16 entry corresponding to a digest (indicated by reference numeral  
17 28 on Fig. 25) can be created by selecting representative  
18 portions of the recorded materials. In particular, in Fig. 24  
19 the portions selected for the digest are shaded, and include  
20 portions defined by the pairs of time codes TCA and TCB; TCC and  
21 TCD; TCE and TCF; TCG and TCH; and TCI and TCJ. The diagram of  
22 Fig. 25 illustrates the data structure at a time when the first  
23 three of these segments have been associated with the digest  
24 entry 28. It will be noted that the digest entry 28 is at the  
25 title level, while the excerpts associated with the digest entry

1 are at the chapter level. Also shown in Fig. 25 are another  
2 title level entry with the name "body" indicative of the entire  
3 movie, and four chapter level entries associated with the "body"  
4 title level entry.

5 After the digest entry has been formed, selection of  
6 the digest entry for reproduction causes only the segments  
7 represented by the chapter level entries associated with the  
8 digest entry to be reproduced, so that, for instance,  
9 representative portions lasting, e.g., thirty minutes are viewed  
10 instead of an entire movie that may comprise two hours, for  
11 example, of recorded material.

12 Formation of the digest entry may be carried out using  
13 a menu-based and/or graphical user interface such as has been  
14 previously discussed with respect to Figs. 12, 13 and 15-22.

15 There will now be described a data packet used as a  
16 format for storing the information in the recording medium  
17 cartridge memory. In a preferred embodiment, all of the  
18 information stored in the memory, or all information other than  
19 image information, is provided in the form of fixed length  
20 packets in the format now to be described. As shown in Fig. 26,  
21 the data packet is formed of five data bytes of eight bits each.  
22 The first byte, PC0, is data which identifies the type of data  
23 contained in the balance of the packet. The format of the last  
24 four bytes, PC1-PC4, is determined in accordance with the  
25 identifying data contained in the first byte. The last four

1 bytes are for storing the actual data to be included in the  
2 packet. The first byte, for the identification information, is  
3 divided into an upper four bit segment and a lower four bit  
4 segment. The upper four bits are a code indicative of which  
5 level in the tree structure the data in the packet belongs to,  
6 whereas the lower four bits identify, for example, the type of  
7 data contained in the last four bytes of the packet. It will be  
8 noted that the upper four bits may indicate one of up to 16  
9 different levels, while the lower four bits may indicate one of  
10 up to 16 different types of data.

11 In particular, with respect to the upper four bits, and  
12 referring to Fig. 27, there are shown four different level codes  
13 as defined in a preferred embodiment of the invention.  
14 Specifically, the code 0001 corresponds to the title level, 0010  
15 corresponds to the chapter level, 0011 corresponds to the part  
16 level, and 0100 corresponds to the program level. Other codes,  
17 of course, can also be defined. Since the first four bits of the  
18 first byte indicate the tree level, the level to which the data  
19 belongs can be determined simply by reading the first four bits  
20 of the first byte of the data packet.

21 There will now be described additional details  
22 concerning storage of information in, and retrieval of  
23 information from, the recording medium cartridge memory.

24 In particular, Fig. 32 illustrates an alternative  
25 manner in which directory entries may be created in connection

1 with recording operations. In the procedure illustrated in Fig.  
2 32, a recording operation begins with step S101 at which a  
3 recording and reproducing apparatus (such as VTR 51 of Fig. 31)  
4 is preprogrammed to carry out a recording operation. The  
5 preprogramming is carried out in a conventional manner,  
6 including, for example, input of information regarding the  
7 program to be recorded such as the starting and ending times of  
8 the program and the channel on which the program will be  
9 broadcast. Alternatively, a system in which the program is  
10 identified by a code may be used, in which case the appropriate  
11 code information is input. The procedure continues with step  
12 S102, at which the recording and reproducing apparatus determines  
13 whether the input starting time has occurred. The recording and  
14 reproducing apparatus continues to await the starting time until  
15 it occurs, and when the starting time is detected, the apparatus  
16 commences recording the program (step S103). The recording  
17 continues and at the same time the apparatus awaits the entered  
18 ending time (step S104), at which point recording ceases and the  
19 operation ends with entry of appropriate starting and ending  
20 point data in the cassette memory (step S105). It will be  
21 appreciated that the creation of the directory entry may take  
22 place beginning with step S103 (i.e., at the commencement of the  
23 recording operation), with the ending point being entered on  
24 detection of the end time, and termination of recording, in step  
25 S105. Each of the starting and the ending time may be provided



1 in the form of a code representing a time code or a frame number,  
2 and each code may be stored in a separate data packet of the type  
3 described with reference to Figs. 26 and 27. Thus, the two data  
4 packets respectively corresponding to the starting point and the  
5 ending point together form a basic data item of the type shown in  
6 Figs. 1(a) or 1(b).

7 Moreover, step S105 may include the addition of other  
8 information to the basic data item, as was described with respect  
9 to Figs. 3-5. That information may include text information such  
10 as a program name or a date of recording and/or may include image  
11 data representing a frame of the recorded material.

12 With respect to text data, the text to be added to the  
13 data item may be formed by operating the remote control unit 54  
14 (Fig. 31) in response to a text editing display displayed on the  
15 TV 52, such as that shown in Fig. 33. Referring to Fig. 33, it  
16 will be noted that the text editing display includes a list of  
17 alpha-numeric and other characters, as well as function "buttons"  
18 and an accumulated text display line used for text editing. The  
19 display also has a cursor (indicated by reference numeral 80)  
20 which may be repositioned by operating directional keys or the  
21 like on the remote control unit. Operation of a "select" key or  
22 the like on the remote control unit 54 results in selection of  
23 the character or function to which the cursor is pointing.

24 Some or all of the identifying information may also be  
25 provided by means of the VBID decoder 70 of the VTR 51 (Fig. 31).

1 In particular, the program name and/or the date may be contained  
2 in a code present in the vertical blanking interval of the tuned  
3 signal provided by tuner 58. The information may be extracted by  
4 VBID decoder 70 and provided to microprocessor 64 for storage as  
5 part of the data item in the memory 45.

6 If the additional information to be added to the data  
7 item includes an image representative of the recorded material  
8 (as in the data item of Fig. 5), the remote control 54 may be  
9 operated (by actuating an "INDEX" button for instance) to cause  
10 microprocessor 64 to receive (via output processor 62 and frame  
11 memory 72) image data representing a frame of a video signal  
12 reproduced from the tape 6. Microprocessor 64 then causes the  
13 image data to be stored in the memory 45. Alternatively, a frame  
14 of image data may be automatically supplied from video signal  
15 processor 60 to microprocessor 64 for storage in memory 45 each  
16 time recording is initiated.

17 Fig. 34 illustrates a format in which the information  
18 stored in the recording medium cartridge memory may be displayed  
19 on the TV receiver 52 (Fig. 31) during, for example, step S3 of  
20 Fig. 15. Referring to Fig. 34, it will be observed that a header  
21 portion of the display includes title information and other  
22 information identifying the cartridge as well as the current date  
23 and time. The next entry indicates how much recording capacity  
24 remains on the recording medium in the cartridge. There follows,  
25 in the form of a table, name and date information and other

1 information concerning three programs recorded on the cartridge.  
2 There is also a bar chart indicating the relative lengths of the  
3 programs and the unrecorded area in the cartridge.

4 Although not shown in Fig. 34, the display may also  
5 include a cursor or other indication to permit selection of one  
6 of the recorded programs for reproduction, editing, and so forth.

7 Fig. 35 illustrates another format for displaying  
8 program index information as, for example, in connection with  
9 step S3 of Fig. 15. Referring to Fig. 35, it will be observed  
10 that the display is in the form of a split-screen, divided into  
11 four quadrants, with the upper left hand, upper right hand and  
12 lower left hand quadrants each displaying an image representative  
13 of respective program segments that have been recorded on the  
14 cartridge. It will be appreciated that this display format may  
15 be used when each of the program segments has a corresponding  
16 directory entry that includes image data representing a frame of  
17 the program segment. Again, although not shown in Fig. 5, a  
18 cursor or the like may be used to select for reproduction a  
19 program segment represented by the corresponding image frame.

20 According to the method of storing information in a  
21 recording medium cartridge memory as described herein, a number  
22 of program segments can be grouped together by storing  
23 corresponding data items in the memory in the form of a tree  
24 structure. This data structure facilitates retrieval of the  
25 information stored in the memory and also facilitates access to

1 the program materials recorded on the recording medium. The  
2 information stored in the memory also preferably includes data  
3 relating to the recording medium, the manufacturer of the  
4 cartridge, and so forth.

5 The data structure described herein also makes it  
6 possible to provide options for the user of the cartridge,  
7 including creation of additional data items and adding of  
8 identifying information and the like to existing data items to  
9 aid in the management of the recording medium cartridge and the  
10 materials recorded therein.

11 It will also be noted that the information stored in  
12 the cartridge memory can be conveniently displayed in the form of  
13 a table or list, or if image data is stored in the memory, images  
14 representative of the recorded materials can be conveniently  
15 displayed. Further, the data structure facilitates  
16 classification of the various types of recorded materials, so  
17 that operation of the recording and reproducing apparatus and  
18 management of the recorded materials is made easier.

19 Although the invention has been described largely in  
20 terms of recording of video signals, it should be understood that  
21 the invention can also be advantageously applied to music and  
22 other types of audio recordings, as well as recording of other  
23 types of materials. It should also be understood that the  
24 invention may be applied with respect to other types of recording

1 media in addition to video tape cassettes and may be applied in  
2 other types of apparatus in addition to video tape recorders.

3 Having described specific preferred embodiments of the  
4 present invention with reference to the accompanying drawings, it  
5 is to be understood that the invention is not limited to those  
6 precise embodiments, and that various changes and modifications  
7 may be effected therein by one skilled in the art without  
8 departing from the scope or spirit of the invention as defined in  
9 the appended claims.

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